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Mobilities, Entanglements, Transformations.

Outline of a Research Project on Pottery Pratices in Neolithic Wetland Sites of the Swiss Plateau

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Abstract

A large number of Late Neolithic sites (3900–3500 BC) in Switzerland, southern Germany and eastern France offer outstandingly well-preserved stratified archaeological materials. Due to the wide use of dendrochronology, settlement remains and artefact assemblages can now be placed into a precise and fixed chronological framework, thus presenting a unique case within prehistoric archaeology. In earlier research, chronological and regional units were constructed on the basis of pottery. These spatial and temporal units of typical pottery sets were understood as 'Neolithic cultures', i.e. as culturally more or less homogenous entities connected with (ethnic) identities. Today, with a larger data corpus of excavated settlements at hand, we can begin to understand that this period of the past was in fact characterised by a multitude of cultural entanglements and transformations. This is indicated by the occurrence of local and non-local pottery styles in one and the same settlement: for example Cortaillod pottery typical for the region is found together with NMB-styled pottery in settlements at Lake Neuchâtel, and Michelsberg pottery regularly occurs in settlements at Lake Constance, where Pfyn pottery style is the typical local one. These and many more examples show that there must have been complex entanglements of social ties expanding between eastern France, southern Germany and the Swiss Plateau. Given these circumstances the former notions of Neolithic culture should be critically revised. Therefore, the Prehistoric Archaeology Department at the Archaeological Institute of the University of Berne started a four-year research project funded by the Swiss National Science Foundation in late 2014, called: 'Mobilities, Entanglements and Transformations in Neolithic Societies of the Swiss Plateau (3900–3500 BC)'. Its objective is to address the topic sketched above by adopting a mixed methods research (MMR) design, combining qualitative and quantitative approaches from archaeology and archaeometry. The approach is theoretically based on Pierre Bourdieu's reflexive sociology and his concept of habitus but includes further concepts of practice theories. By shifting the focus to the movement of people, ideas and things – to pottery production practices in contexts of mobility – a deeper understanding of the transformative capacities of encounters can be achieved. This opens the path for new insights into Neolithic societies including social, cultural and economic dynamics that were underestimated in former research.

Key words: Mixed methods research, culture, habitus/social practice, p-XRF analysis, multivariate statistics, archaeometry, Neolithic wetland sites, pottery, 4th millennium BC.

1. Aims and research questions

The project's main objective is to gain a deeper understanding of the complex relations between social groups living in wetland sites on the Swiss Plateau between 3900 and 3500 BC. These relations can be observed in similarities and differences in the material culture of contemporaneous settlements. The majority of a site's artefacts show typically local or regional features: pottery was made in the typical regional style and out of locally available clays. As a starting point we hypothesise that pottery was usually made by local communities sharing specific pottery production practices and using materials that were available near their settlements. However, very frequently we also find vessels made in different styles out of local AND/OR not locally available raw materials in these settlements. Our study aims at tracing such phenomena by focussing on pottery production practices[1]. In order to understand social ties, mobilites and possible triggered transformations on the basis of ceramics we need to elaborate on how the typical regional pottery styles looked between Lake Neuchâtel and Lake Constance during the first half of the 4th millennium BC as well as in the neighbouring regions. Furthermore, different modes of production and usages of clays and tempers (pottery production practices) need to be approached by analysing the pottery of selected settlements. Thus our subordinate research questions are:

- How can local practices of pottery production in a settlement be recognized and differentiated from others belonging to more distant places?
- How can we determine in large quantities whether vessels were produced locally or brought to the settlements from outside?
- What could different pottery styles and pottery practices in one single settlement tell us about people's mobilities and social ties?
- What were the different ranges and directions and possible contexts of mobility?
- Did the encounter of people with different pottery practices transform local pottery productions? Were new vessel types, styles or techniques appropriated or rejected on local scale? Did they trigger changes?

We approach these phenomena by multi-sited archaeology and the analysis of pottery from selected key sites between

[1] As a second priority, the geological provenance of raw materials used for stone stools will be investigated; this part of the project will not be elaborated upon in this paper.

Lake Neuchâtel and Lake Constance (see 3. Case studies). The precise chronology and outstanding archaeological conservation of wetland sites in these regions allows us to follow the phenomena of mobility, social ties and transformations in a very close way. The project's main objectives are:

- Elaborating a mix of qualitative and quantitative methods from archaeology (humanities), and archaeometry (science) to address mobility and pottery production practices.
- Recognizing objective regularities and deviations in data using (multivariate) statistics in order to characterize typical local pottery production practice and finding vessels made in different styles or with non-local raw materials.
- Investigating the creative processes of pottery production in a context of mobility and encounter: using qualitative methods to understand the making of individual vessels, interpreting decisions about the raw material, style and technological choices of the potters.

However, in order to address the inherent dynamics connected to peoples' mobilities with a coherent conceptual framework, a critical review of the former research and its notions of Neolithic societies first needs to be undertaken. This is inevitable because some of the currently used pottery classification systems and typologies were linked with the construction of more or less static, homogeneous and spatially bounded 'Neolithic cultures'. Only by revealing these, often unconsciously made, projections of our notions about Neolithic societies into the past can the biasing of our research by our own contemporaneous perspectives be controlled and reduced.

2. State of research

Because of the above-mentioned link made by former European research between pottery, 'Neolithic cultures' and ethnic identities, fundamental changes in material culture were, for a long time, explained by migrating people. Researchers who were more sceptical about ethnic interpretations of material culture patterns have addressed these transformations carefully as 'foreign influences', thus avoiding the questions of social categories 'behind' the artefacts

Reflection on concepts of 'Neolithic cultures'

In the early 20th century, archaeological cultures were first and foremost conceptualizations (Kossinna 1911; Childe 1925, 1950). In the context of 19th century thought they were understood as material expressions of past ethnic realities but also functioned as tools to establish chronological frameworks (Lüning 1972; Wotzka 1993; Hafner/Suter 2003; Roberts/Vander Linden 2011). With the introduction of radiocarbon dating and dendrochronology, however, the notion of archaeological cultures was that chronologically relevant types of material culture –mainly pottery – could be equated with social groups and deductively coherent bounded entities could be constructed.
While, as we shall see in the following, the 'Neolithic cultures' served more as chronological and spatial entities, the idea that they represented ethnic groups was still perpetuated even though the latter stayed less outspoken (Fig. 1).

During the 20th century very different ways out of this issue – the problematic a priori linking of constructed archaeological cultures with imagined ethnic entities – were chosen. These new directions followed not only paradigmatic shifts in archaeology over the following decades but they were also informed by national research traditions (Veit 1990; Wotzka 2000; Eggert 2013; Demoule 1999; Müller-Scheßel/ Burmeister 2006; Vander Lindern/Roberts 2011). British scholars following post-processual archaeology rejected the notion of archaeological cultures but stressed the active role of material culture and its meanings in the processes of identity formation and in the reproduction of social relationships, status etc. (e. g. Hodder 1979, 1982; Shanks/ Tilly 1987; Jones 1997; Insoll 2007). Furthermore, inspired by some post-structural French sociologists and philosophers, social anthropology as well as material culture studies in general (e. g. Bourdieu 1977; Appadurai 1986; Miller 1998, 2005; Latour 2007; Ingold 2013), archaeological studies themselves became more and more contextual and relational.
In current French, Swiss and German Neolithic wetland archaeology, most scholars currently use the terms of archaeological cultures as termini technici, as classificatory tools, more or less free of social implications (Lüning 1971; Hafner/Suter 2003; Stöckli 2009). However, questions concerning cultural and social aspects have not completely disappeared; instead they are now incorporated into different methodical designs.
In the following, a few scholars who have searched for new ways to address these aspects shall be mentioned: French scholars of the cultural technology approach investigated raw material use, production modes and styles of objects following the concept of the châine opératoire (Arnal/ Bénazet 1951; Leroi-Gourhan 1964; see Vander Linden/ Roberts 2011). Since the late 1980s and the increasing use of dendrochronology, studies on Neolithic wetland

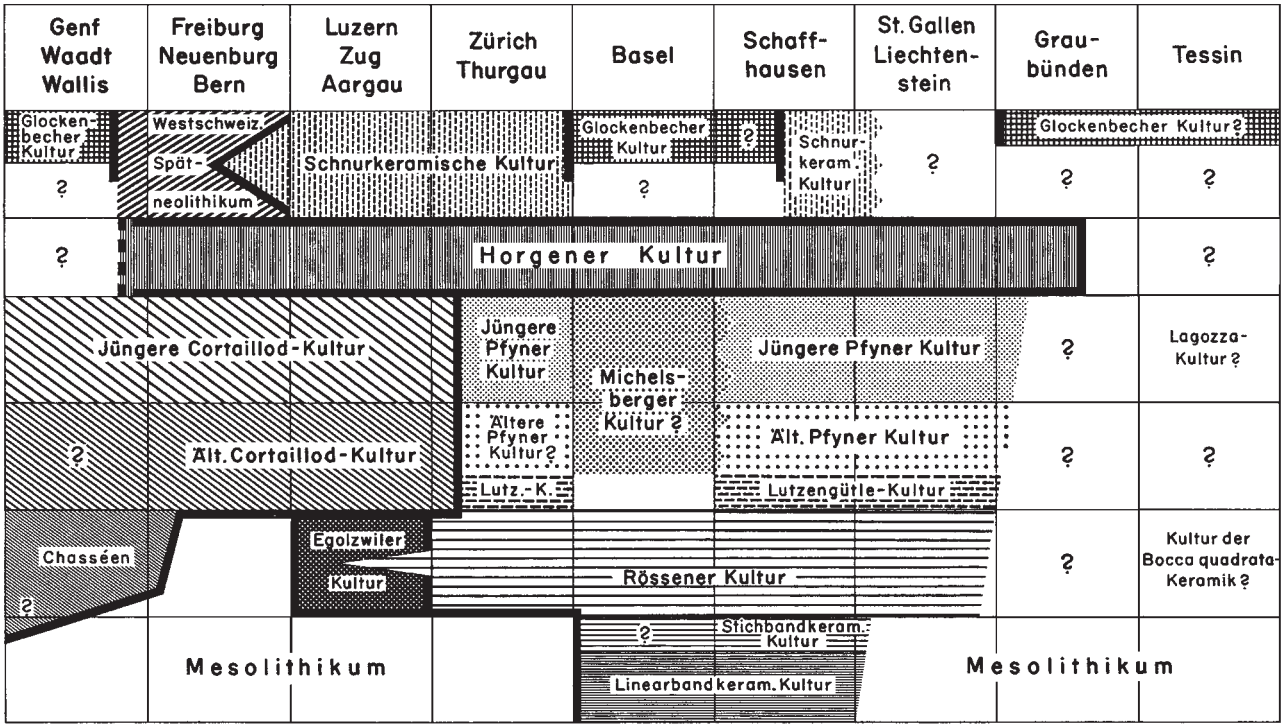


Fig. 1: Chronological table with 'Neolithic cultures', published in the 1960ies by Emil Vogt (Vogt 1967).

sites have followed the dynamics of spatial and temporal variation in material culture by focussing on small-scale mobility, networks, and the transfer of things and ideas through ethno-archaeological approaches (Pétrequin et al. 1987/1988, 1993b). In German Neolithic archaeology, some innovative attempts have been made by taking Pierre Bourdieu's habitus-concept as a theoretical basis in order to understand the reproduction of cultural standardizations and variability detectable in material culture and linking it in some cases with the implementation of multivariate statistics and GIS-analysis (Furholt 2008, 2009, 2011a; Bartholdy 2010; Dammers 2009; Kerig/Shennan 2012). In Swiss Neolithic archaeology a few suggestions going in the same direction have also been made. However, few scholars have so far targeted the concepts of culture explicitly by criticizing them theoretically (see below, Hafner/Suter 1997, 2003; Doppler/Ebersbach 2011; Doppler et al. 2012).

To sum up, many current studies in Neolithic wetland archaeology address the topic more implicitly and are characterized by a strong empirical basis. They focus rather on issues like houses and households, settlement and population dynamics, mobility and migration, circulation of things, networks and social relationships as well as on the interrelationship between humans and the environment (e. g. Burri-Wyser/Loubier 2011; Ebersbach 2013; Doppler/Ebersbach 2011; Leuzinger 2000; Matuschik et al. 2010; Matuschik 2011; Pétrequin et al. 2012; Bailly 2013; Hafner/Heitz/Stapfer 2014). Still, there is a lack of studies combining theoretical issues of culture, material culture, social groups, entanglements, mobility, transformations and related topics with empirical investigations that go beyond the dichotomy of migration versus acculturation (for the latter see Burmeister 2013; Eggert 2013).

'Foreign influences' and changes in the material culture of wetland sites of the Swiss Plateau (3900–3500 BC)

The current terms for Neolithic cultures within our area of research were mainly defined on the basis of pottery (Vogt 1934; Von Gonzenbach 1949; Winiger 1971; Driehaus 1960; Lüning 1967; Pétrequin (ed.) 1986). In the following we refer to them as stylistic groups. In the Swiss Plateau, two main pottery styles can be differentiated (Fig. 2a–c):

- 1) The Mediterranean-influenced Cortaillod pottery style with round vessel bases, occurring between Lake Zurich and Lake Geneva.
- 2) The Danubian-influenced Pfyn pottery style (until the 1970s called 'Swiss Michelsberg') with flat-based vessels, known between Lake Zurich and Lake Constance and upper Swabia.
-

Along with principal differences there are also similarities and ties between these two stylistic groups (Hafner/Suter 2002, 2003, 2005b; Stöckli 2009). Furthermore, so-called 'foreign influences' from adjacent material culture groups beyond the Swiss Plateau can be noticed as well.

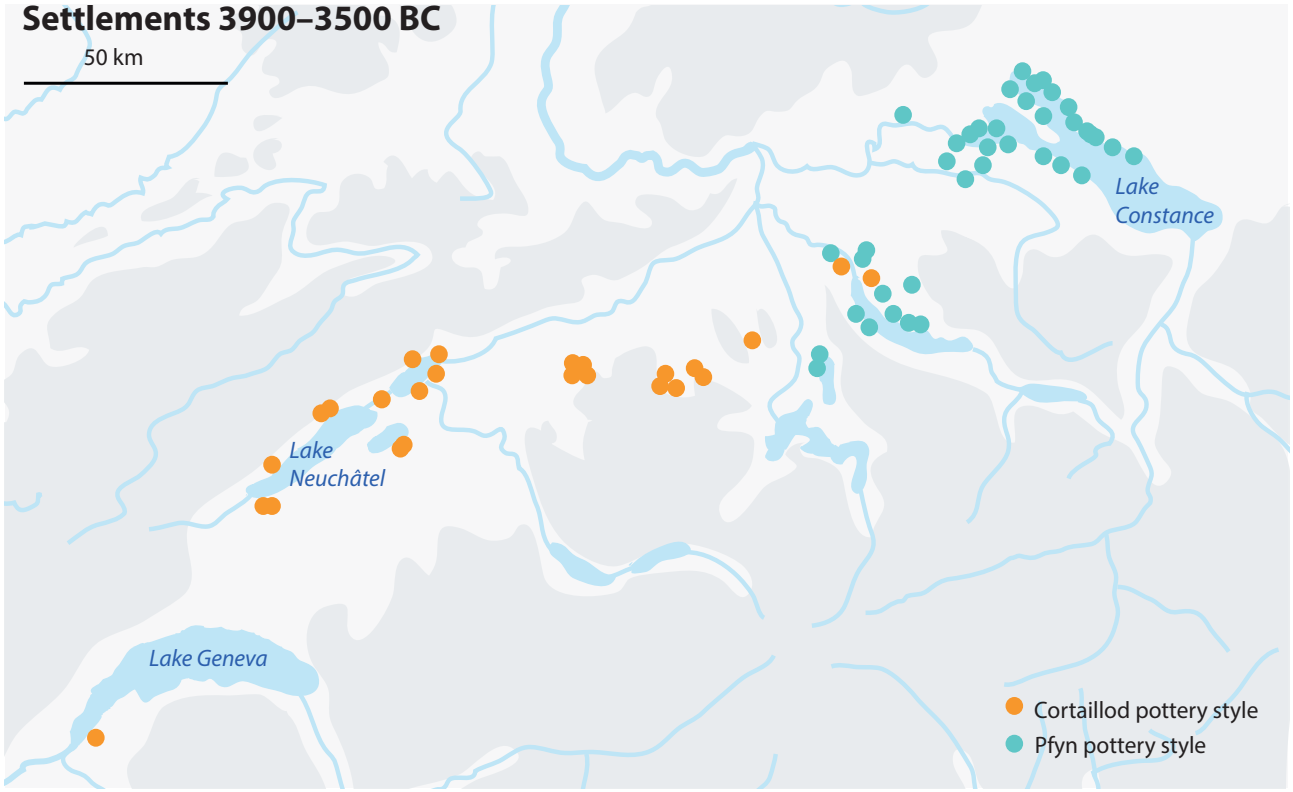


Fig. 2: a. Wetland sites in Switzerland and Southern Germany having Pfyn/Hornstaad or Cortaillod pottery styles, dating between 3900 and 3500 BC, as well as typical selections of vessels (R. Stapfer/C. Heitz).

Fig. 2: b. Cortaillod pottery from Twann-Bahnhof (BE/CH) (B. Redha Archäologischer Dienst des Kantons Bern).

Fig. 2: c. Pfyn pottery from Gachnang-Niederwil (TG/CH) (D. Steiner, Amt für Archäologie des Kantons Thurgau).

Western Switzerland

In many Cortaillod wetland sites, material entanglements in pottery assemblages and in the raw materials of stone artefacts have been discovered over the last thirty years (e.g. Stöckli 1981 a+b; Nungässer/Maggetti/Stöckli 1985; Stöckli 2009; Willms 1980; Piningre 1974; Diethelm 1994; Joye 2008; Burri 2007; Burri 2009; Burri-Wyser/Loubier 2011; Stapfer 2012). Although 'foreign' pottery (imported finished vessels) was rarely identified as such, 'special' pottery made with unusual raw materials could be separated from the majority of 'regular' pottery made with local clay and temper. Sometimes the unusual raw material seems to be exogenous but mostly it can be attributed to local sources around the settlements that were not exploited for 'regular' pottery. This means that some Neolithic potters must have been looking for local clays with particular material characteristics (e.g. Nungässer/Maggetti 1978; Nungässer/Maggetti/Stöckli 1985; Suter 1987; Maggetti 2009). Although the results of the archaeometrical studies are very promising, only a few reference groups of the macroscopically different materials (pottery and stone tools) have been analysed so far (Maggetti 2009). The reasons for this deficit can be found in the time-consuming and expensive nature of the methods (thin-section and traditional XRF analysis). Furthermore, the social networks and cultural dynamics linked to these 'foreign influences' have never been studied in detail.

So far, it seems that strong influences come from the Néolithique moyen Bourguignon (NMB), located in Burgundy and Franche-Comté (eastern France), whereas the impact from the Pfyn pottery style seems to be much lower. With the publication of the Neolithic pottery of the site of Concise-sous-Colachoz (western Switzerland, Lake Neuchâtel, Burri 2007) as well as the pottery of Clairvaux (Jura, France, Jammet-Reynal 2006), a considerable quantity of precisely dated NMB pottery was presented for the first time (Fig. 3a–c)

Two recent studies define and classify this stylistic group to a further extent (Jammet-Reynal/Pétrequin/Besse 2010; Jammet-Reynal 2012; Moreau 2010). Prior to this, the style and development of NMB pottery was barely known because most of the NMB sites in eastern France are not precisely dated.

The finds from Concise allowed the identification of NMB pottery at other sites of western Switzerland. Local Cortaillod and 'foreign' NMB pottery differ in style and temper: while Cortaillod pottery is S-shaped with knobs around the border and tempered with quartz and sand, the NMB-style

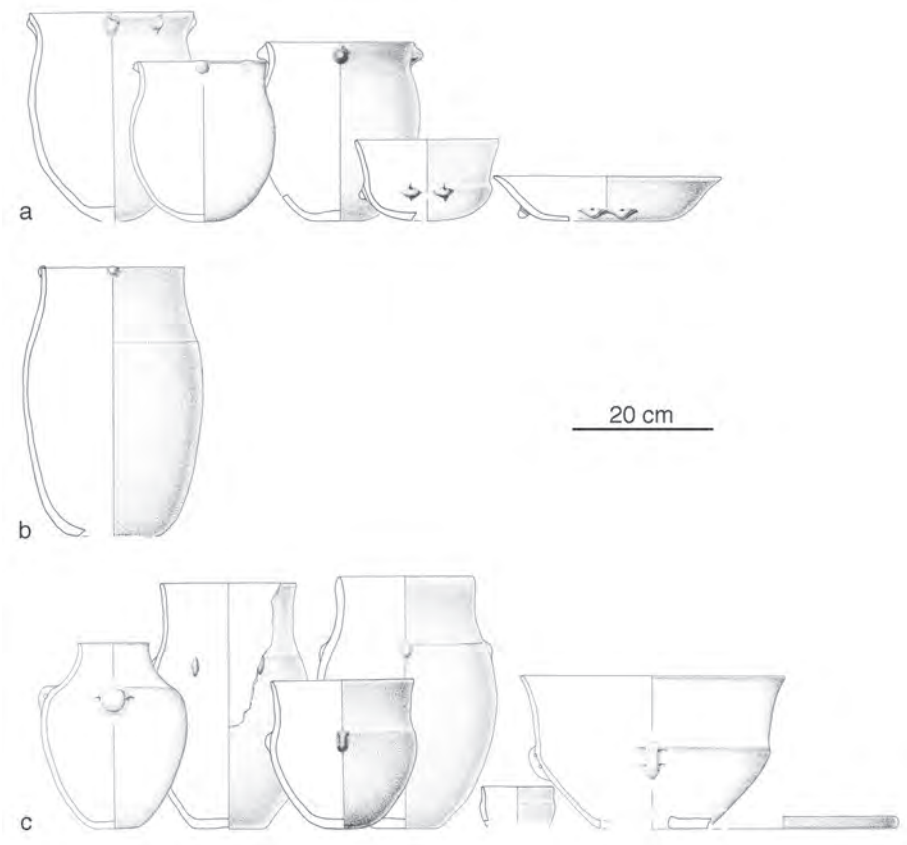


Fig. 3: Cortaillod (a), NMB (b) and mixed pottery (c) from the settlement Concise-sous-Colachoz (3713-3675 BC) at Lake Neuchâtel (R. Stapfer after Burri 2007).

vessels are characterized by shoulders accented by knobs and tempered with limestone or calcite (Burri 2007). A small number of raw material analyses showed that NMB pottery was either imported from the western side of the Jura Mountains (Nungässer et al. 1985), or produced locally (Burri 2007).

At Cortaillod sites, stone axes of black shale (aphanite) deriving from the Vosges (France) can be noticed as a second 'foreign' element (e.g. Willms 1980; Piningre 1974; Diethelm 1994; Pétrequin/Jeudy/Jeunesse 1993; Pétrequin 1993a). Furthermore, some stone axes, which macroscopically do not differ from the imported black shale stone axes, derive from local moraine and could be interpreted as 'imitations' of the imported stone axes (Joye 2008; Diethelm 1989). Apart from these raw materials, rare jadeite and other rocks were also found to derive from the Monte Viso and the Monte Beigua in western Italy (Joye 2008; Pétrequin et al. 2012). This shows that wetland sites in western Switzerland were part of a broad exchange network of large hand axe blades, spread throughout the whole of western Europe and the British Isles in the 5th and early 4th millennium BC.

North-Eastern Switzerland, Southern Germany

IIn the Lake Zurich region, major transformations in material culture were observed in settlements dating to around 3800 BC. They have been referred to as the 'transition from Cortaillod to Pfyn culture'. Hypotheses explaining these changes were torn between the migration of people and the inclusion of cultural innovations. Due to the lack of systematic comparative quantitative archaeological and archaeometrical investigations, these hypotheses have not yet been verified or rejected in a satisfactory manner (Kustermann 1984; Suter 1987; Bleuer/Hardmeyer 1993; Gerber et al. 1994; Biel et al. 1998; Knopf 2002; Hafner/Suter 2003; Stöckli 2009).

However, in the settlements with Pfyn pottery dating into the 38th, 37th and 36th century BC, round knobs on the rims of pots, gynaecomorphic vessels and some rare beakers of deer antler show ties between central and western Switzerland. Crucibles for copper-melting and copper objects (Mondsee copper), as well as gynaecomorphic jugs and Bavarian flints show ties to Danubian regions (Biel et al. 1998; Cevey et al. 2006; Lichter 2010; Matuschik et al. 2010; Matuschik 2011).

The occurrence of vessels in Michelsberg and Munzingen style in settlements that have mainly Pfyn pottery show relations with the Upper Rhine Valley, Kraichgau, Hegau and Upper Swabia in Germany (Biel et al. 1998; Jeunesse 1997; Lefranc et al. 2011; Seidel 2008, 2011; Höhn 2002; Matuschik et al. 2010, Matuschik 2011) (Fig. 4a–c).

At Lake Constance, thin-sections and chemical analyses of pottery have proven that some of the Michelsberg-styled vessels might have been imported from the Hegau, by reason of them having a volcanic and illitic temper. Others, however, were produced with local clays yet show Michelsberg technique and style. The hypothesis was set up suggesting that aspects of Michelsberg pottery were appropriated, thus triggering changes in the Pfyn pottery style around 3800 BC (Biel et al. 1998; Matuschik 2011).

Besides pottery, hammer axes made of basalt found in settlements around Lake Constance could also indicate relationships to the Hegau region. Flint varieties originating from Monte Lessini (Northern Italy) and Rijckholt (Northern Germany), however, point to long-distance networks (Leuzinger 2000; Biel et al. 1998; Matuschik et al. 2010).

Two current research projects dealing with regions next to the Swiss Plateau promise to give new insights that could be included into our own studies: The French-German research program 'MK-Project - Emergence of the social complexity' promises to give new insights on the social, cultural and economic transformations of the 'Michelsberg-culture' on a broader scale, which will also be relevant for the wetland sites (Gleser/Becker 2010; Dubouloz et al. 2010). The German DFG-project 'Siedlungsstrukturen der Michelsberger Kultur im Kraichgau' will yield important findings about chronological details and cultural influences in that region. It is particularly important for the wetland sites on the Swiss Plateau because of their proximity to the Kraichgau (Seidel 2013).

Conclusion on the state of research

In the material culture of the wetland sites between Lake Neuchâtel and Lake Constance, different phenomena indicate different forms of mobility and far reaching social ties. The settlement pottery shows regularly that vessels of non-local styles were imported to the site or were even made locally. Furthermore, the pottery styles of Michelsberg, NMB, Munzingen, Cortaillod and Pfyn share some stylistic features indicating that the flow of ideas and things linked to the mobility of people between 3900 and 3500 BC triggered transformations within the local material culture.

Mineralogical-petrographic determinations of lithic raw materials, used for stone tool production, show that not only local varieties were collected. Rather, rare jadeite, black shale (aphanite), basalts etc. were exchanged from their geological sources over long distances. Furthermore, rare flint varieties indicate that far reaching networks of the Jura Mountains, the Paris Basin, southern France, northern Italy and southern Germany must have existed during the 1st half of the 4th millennium BC.

Current studies focus on dense, precise one-site studies or on large supra-regional perspectives. For a better understanding of these material culture entanglements, multi-sited projects are vital. Remains from wetland sites published in about the last 50 years need to be re-considered and updated to today's state of research. In addition to a comparative approach, archaeological qualitative and quantitative methods from the humanities and science should be combined in order to gain new insights in this research field. In order to explore relationships in material culture, data should be analysed using multivariate statistics. We see a huge potential in the use of broad, comparative raw material analyses to answer questions about different ranges and directions of mobility and the impact of mobile people on pottery production practices.

3. Case studies

The project adopts a wide, comparative multi-sited approach in which the material culture's entanglements from selected key sites will be analysed in detail and then embedded in their regional and supra regional contexts (Fig. 5). This approach will be applied in two case studies corresponding to two PhD programs.

While their regional and supra regional contexts will be studied by the elaboration of chronological correlations

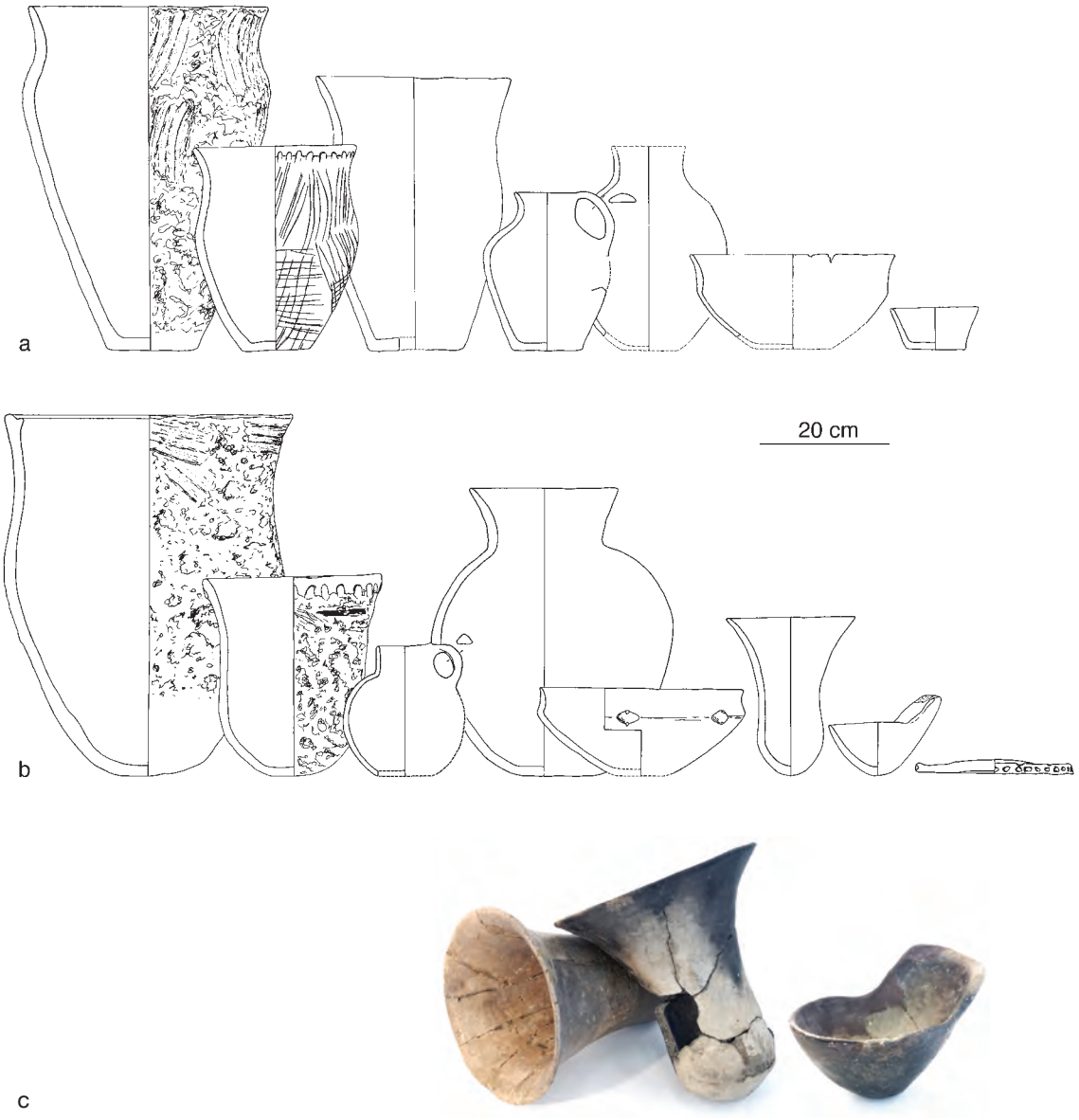


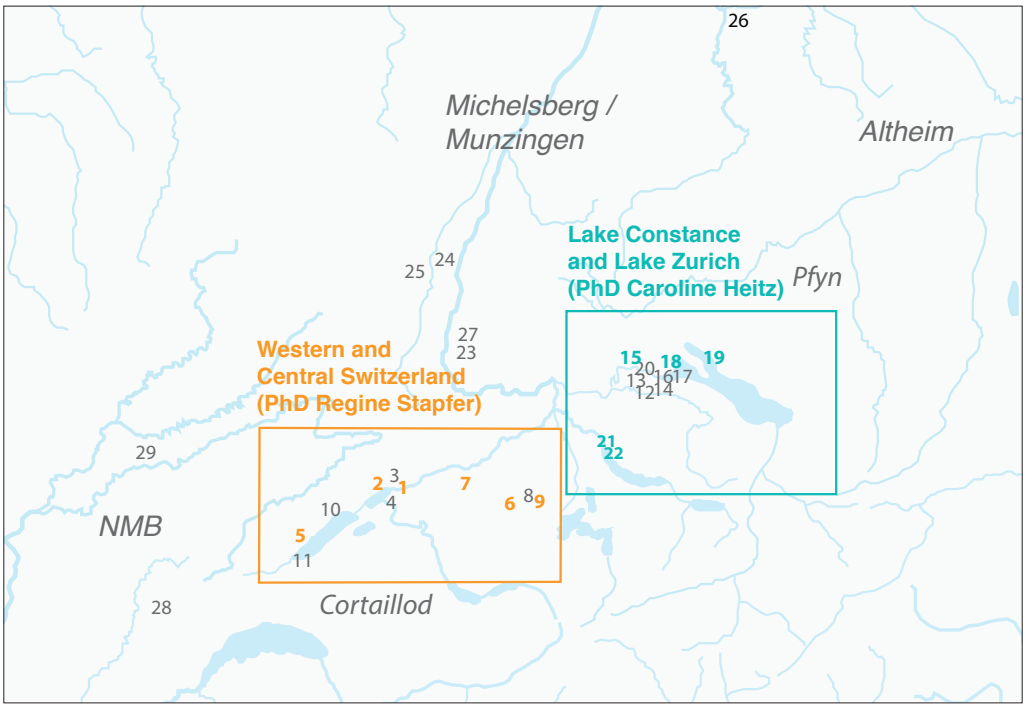
Fig. 4: Typical local Pfyn pottery (a) and Michelsberg pottery (b) as well as Michelsberg tulip beakers and a ladle (c) found at the settlement Thayngen-Weier in Lake Constance region (drawings: Winiger 1971, photo: C. Heitz).

and comparative stylistic analyses, with published data of second priority sites, a profound understanding of the phenomena will be achieved through detailed analyses of the archaeological finds from selected primary key sites (Fig. 6a–b).

Besides their different empirical fields, the PhD-thesis of case study 1 focuses on the elaboration of a workflow for p-XRF-analysis, while the PhD-thesis of case study 2 focuses on the elaboration of a theoretical framework connected to the mixed-methods approach of the project. However, after its elaboration, the knowledge will be shared and the overall approach will be applied to both case studies in the same manner.

Case study 1: Western Switzerland and entanglements in Cortaillod styled pottery

In this case study, the Neolithic societies of western Switzerland and eastern France (39th to 36th century BC) will be analysed on a regional and supra-regional level. First, two settlements deriving from the bay of Sutz-Lattrigen (site Sutz-Lattrigen Hafen, 39th and 37th century BC) will be analysed to fill a research gap in this region (Hafner 2005, 2011). After this, the material culture, especially NMB, raw pottery materials and, in a further step, stone tools of non-local origin (possibly originating from the Vosges (F)) from formerly published neighbouring sites



Key sites Western and Central Switzerland

1: Sutz-Lattrigen
2: Twann Bahnhof
3: Port-Stüdeli
4: Lüscherz Dorfstation
5: Concise-sous Colachoz
6: Egolzwil 4 und 5
7: Burgäschisee N/S/SW/O
8: Sursee Zellmoos
9 : Schenkon Trichtermoos
10 : Auvernier Port
11 : Yverdon Garage Martin

Key sites Lake Constance and Lake Zurich

12: Gachnang
13: Hüttwilen
14: Pfyn-Breitenloo
15: Thayngen-Weier
16: Eschenz-Insel Werd
17: Steckborn-Turgi/Schanz
18: Hornstaad-Hörnle
19: Sipplingen
20: Wangen Hinterhorn
21: Zürich Mozartstrasse
22: Zürich KanSan

Key sites beyond the Swiss Plateau

23: Munzingen
24: Mundolsheim
25: Holzheim
26: Heilbronn-Klingelberg
27: Bötzingen-Häuslisberg
28: Clairvaux-les-Lacs
29: Lavans-les-Dôles

Fig. 5: Selected key sites considered in case study 1 (Western Switzerland) and case study 2 (North-Eastern Switzerland), the primary key sites are indicated in colour (R. Stapfer/C. Heitz).

around Lake Bienne (Twann, Port-Stüdeli, Lüscherz Dorfstation), as well as from selected sites at Lake Neuchâtel (Concise) and on the Swiss Plateau (Burgäschisee, Egolzwil, Schenkon), will be identified and analysed by qualitative and quantitative methods (Key sites see: Hafner/Suter 2005a; Stöckli 1981a+b; Burri 2007; Wey 2001, 2012; Wyss 1983). Besides the analysis of findings from regional sites, selected NMB-style-pottery from the originating area in eastern France might also be studied using feature analysis to facilitate the identification of NMB-pottery in western Switzerland. Combining qualitative and quantitative analyses, social groups, social networks and peoples' mobility will be studied.

Case study 2: Lake Constance and Lake Zurich region and entanglements in Pfyn styled pottery

The second case study gives an in-depth examination into sites in north-eastern Switzerland and southern Germany from the 39th to 36th centuries BC. There, first the so-called Hornstaad and later the so-called Pfyn made up the typical locally produced pottery styles. In a first step, a uniform classification system will be developed in order to detect similarities and differences in shapes and decorations in the research area, using qualitative description and multivariate analyses. In order to understand the entanglements of Pfyn with other pottery styles (Schussenried, Michelsberg, Munzingen, Cortaillod, Altheim), the following key sites will be analysed in detail: Hornstaad Hörnle and Sipplingen (Lake Constance, D), Thayngen Weier (greater Lake Constance region, CH), Zürich AKAD-Pressehaus/KanSan

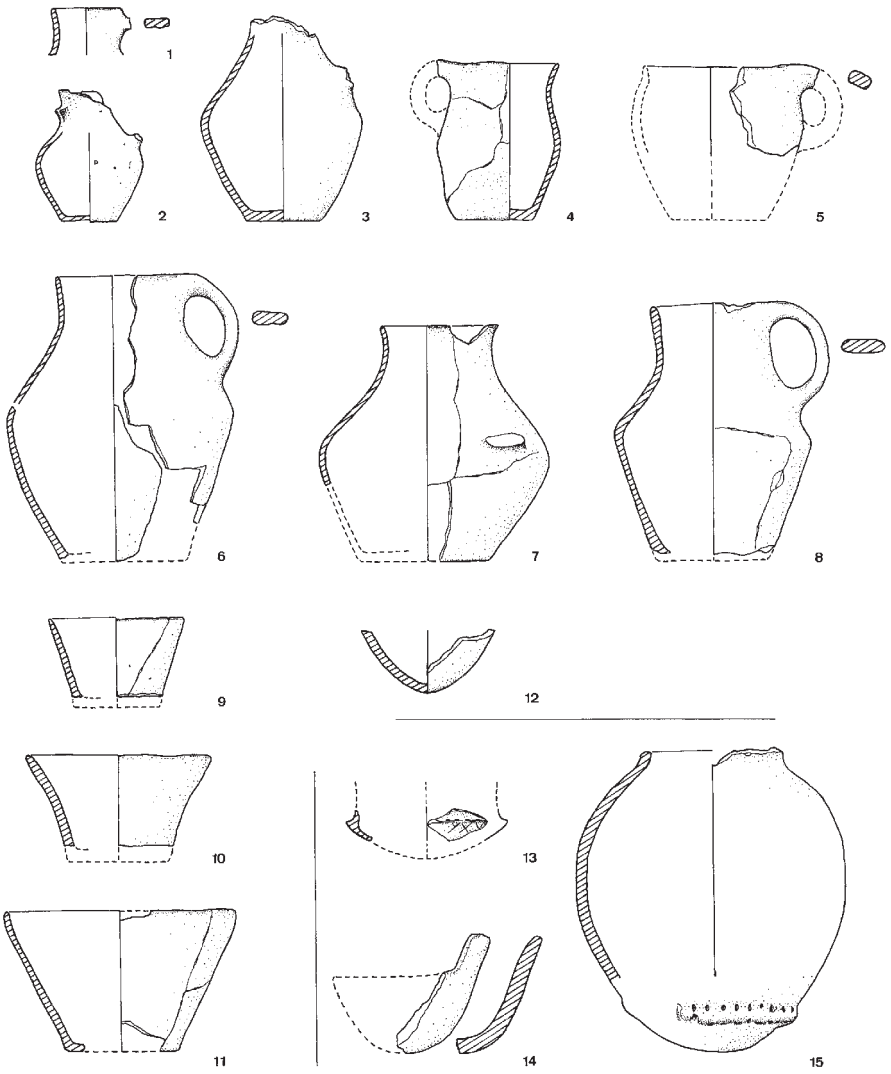


Fig. 6: a. Example of a published catalogue on pottery, originating from the settlement Steckborn-Turgi (TG) at Lake Constance (Winiger/Hasenfratz 1985).

and Zürich Mozartstrasse (Lake Zurich, CH). Thereby, features concerning shape and decoration and production techniques as well as raw materials will be analysed, using methods from archaeology and archaeometry. The key sites were chosen for several reasons: most of them are precisely dated, they all show stylistic heterogeneity and, thanks to their stratigraphies, comprising up to five settlements, transformations in pottery styles can be observed over time. Around 3800 BC, some Michelsberg pottery features, like segmented bowls and slipped surfaces of pots, were appropriated in settlements at Lake Constance, leading to a major transformation in the local Pfyn pottery production. At the same time, in settlements of the Lake Zurich region, Pfyn pottery features were incorporated into local Cortaillod pottery styles, resulting in the creation of a new local Zurich type of Pfyn style. Both examples seem to be linked to the mobility of people and provide a rare opportunity to study the transformative capacities of encounters between individuals and social groups belonging to different communities.

4. Mixed methods research-design

We are convinced that, if we want to address local and supra-regional perspectives, objective structures and individual agencies, qualitative (QUAL) and quantitative (QUAN) methods from archaeology (humanities) and archaeometry (science) need to be combined. Therefore, an accurate theoretical basis is needed. In social sciences, mixed methods research (MMR) approaches are used in similar cases. They structure the combination of different perspectives as well as QUAL- and QUAN-methods of data collection and analysis within one project in a specific and systematic way. Thus, the overall research topic and question

Fig. 6: b. Pottery from the settlement Zürich-Mozartstrasse (ZH) at Lake Zurich currently stored at the Cultural Heritage Service of canton Zurich (C. Heitz).

can be addressed with a coherent methodology (Teddlie/Tashakkori 2009; Creswell/Plano Clark 2010; Guest 2012). The advantages of MMR are: the overcoming of 'paradigm wars' between positivist and subjectivist stances; the solving of the contradictory logic of the stances by e. g. pragmatism, critical realism or historical epistemology as meta-perspectives; the deeper reflection on the relationships between the QUAL- and QUAN-methods during strands of investigation (Fries 2009; Harrits 2011; Schwartz-Shea/Yanow 2012).[2] MMR approaches have rarely been applied in archaeology so far but transferring them to our discipline contains a remarkable but untapped potential for prehistoric archaeology. We have chosen a multiple phase mixed methods research design, guided by well-reflected epistemological, methodological and empirical choices as well as a detailed conceptualization of mixing methods. It includes nine QUAL- and/or QUAN-strands with an overall equal priority (Fig. 7). The level of interaction between the QUAL-, QUAN- or QUAL/QUAN-strands is an interactive one, because they mostly inform each other, being merged or connected subsequently.

Theoretical basis, analytical phases and strands

The basic epistemological problem in the project presented here concerns the antithesis of objectivism and subjectivism, which is immanent in mixing quantitative and qualitative methods from the humanities and science, most pronounced in the debate of processual versus post-processual archaeology (see Boivin 2008; Stockhammer 2011; Veit 2011). We take historic epistemology as a research paradigm by appropriating Pierre Bourdieu's reflexive sociology and praxeology approach as an overall theoretical basis for our MMR-approach (Bourdieu/Wacquant 1992; Bourdieu 2004; Rheinberg 2007; Harrits 2011; Fries 2009). Hence, the project's three sequential phases correspond to the procedure of reflexive sociology:

- **Phase 1: Pinpointing the field of research ('objectivation')**

The aim of phase 1 is to achieve an objective construction of our research object (see Harrits 2011). This includes the following strands:

- Strand 1: Reflecting on researchers' biases

The first strand of this project aims at reflecting on biases produced by the researchers' perspectives, including our own, and our inevitable projections onto the past (Bourdieu/Wacquant 1992). This requires us to reflect on existing classifications, terms, notions and models about Neolithic societies; to locate and understand them in their (historic) context of research: e. g. 'culture', 'foreign influences', 'foreign/special pottery', 'migration', 'tradition'.

- Strand 2: Building up a theoretical basis, defining the field of research

The question we have to ask ourselves then is: what could material culture and especially pottery possibly tell us about past societies? Since we do not have access to emic categorisations of the investigated societies – unlike social anthropology – and we cannot observe the actions of the people, other ways must be chosen in archaeology to figure out relevant fields of investigation. Following Pierre Bourdieu's social praxeology and his concept of 'habitus' – understood as internalized collective dispositions –, we argue that material culture offers an access to shared ways of life within communities and their social practices, but also their individual actions and choices (Bourdieu 1984; Bourdieu/Wacquant 1992). Things played an important role in these processes and therefore we argue that we can identify them in artefacts such as pottery. The most direct way to observe such phenomena in our sources is by looking at the process of making things. Some moments of past human actions within this process of making can be tracked directly in the materiality of the pots. Because the pots were made by humans who had a certain habitus, a certain position in their societies and belonged to a community of practice, we can not approach social practices only through regularities in pottery but must also look at individual actions and choices through variability and deviations in pottery. Therefore, we chose terms and conceptual tools that frame the field of research but still leave enough space to be filled by empirical research later on: habitus, style of actions, agency, social practice, material (pottery) styles, entanglement, appropriation, transformation, mobility etc. (for these concepts see Bourdieu 1984; Dietler/Herbich 1998; Bourdieu/Wacquant 1992; De Marrais et al. 2004; Andresen 2004; Prien 2005; Sellet/Greaves/Yu 2006; Kaiser/Schier 2007; Boivin 2008; Bernard/Wendrich 2008; Knapp/van Dommelen 2008; Wenger 2010; Dobres/Robb 2000; Hahn 2005, 2008, 2011; Salazar 2012; Stockhammer 2011, 2012a, 2013, 2015; Salazar 2012; Hodder 2011, 2012; Huck 2012; Heitz/Guerra 2013; Burmeister 2013; Hahn/Weiss 2013).

[2] Latest developments in the field can be followed in the „Journal of Mixed Methods Research" by SAGE publications.

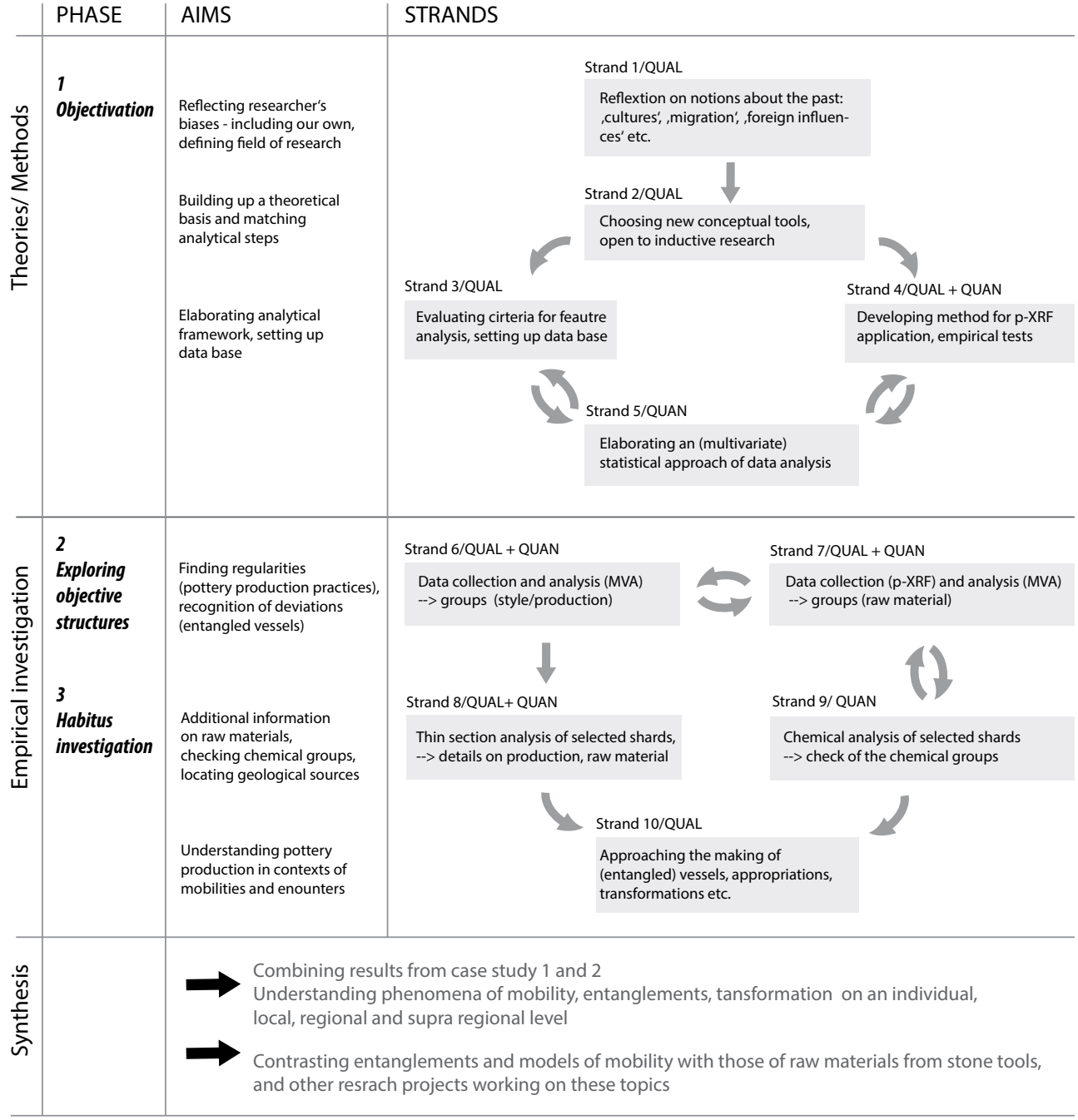


Fig. 7: Multiple phase mixed methods research design with 3 phases and 10 strands, based on Pierre Bourdieu's reflexive sociology (C. Heitz/ R. Stapfer).

- Strand 3: Elaborating an analytical framework, setting up of data base

In keeping with this approach, an objectified, descriptive analytical framework of pottery feature analysis that is open to inductive research needs to be elaborated upon: measurable aspects of shapes and shaping techniques, standardized descriptions of surfaces and surface treatments, applications and decorations, elementary and mineralogical composition clays and tempers etc. Furthermore, besides the 'scholastic biases' other biases must be taken into account in archaeology: processes of past human actions upon pottery (traces of the use and discarding of pottery), natural impact in the cultural layers (taphonomy), current human influences on archaeological finds (preservation measures) etc. A web-based database system will be set up enabling data collection by all project members working on different case studies at the same time.

- Strand 4: Elaboration of p-XRF application

Since our aim is not only to classify pottery by feature analysis but also by analysing the raw materials used for pottery production, Portable Energy Dispersive XRF (p-XRF) has been chosen in order to obtain the chemical composition of large amounts of shards (see below). However, an accurate application of this method for Neolithic coarse ware still needs to be elaborated.

- Strand 5: Elaboration of multivariate statistical approaches

Archaeological data collected by feature analysis, as well as the measured chemical elements of pottery obtained by p-XRF-analyses, needs statistical treatment. Strand 5 therefore deals with the elaboration of different statistical approaches to describe, explore and analyse the structures and relationships in the data, using the software R.

- **Phase 2: Finding regularities and deviations ('objective structures')**

Having elaborated on the overall approach, data will be collected for several key sites within the scope of the two complementary case studies (see above).

- Strand 6: Recognition of different pottery production practices

Following on from the feature analysis of the pottery regarding taphonomy, shape, decoration, raw material and techniques, data can then be explored qualitatively but also quantitatively though implementation multivariate statistics (MVA) (see below, Bourdieu 1984; 2013; Wotzka 1997; Fries 2009; Furholt 2009, 2011b; Doppler 2013). Thereby, we will reveal the objective structures in the data. These are regular combinations of pottery features, e.g. certain vessel shapes and sizes, stylistic conventions, habits of using clays with certain qualities etc. The aim is to find typical local pottery production practices as well as deviations. The latter could be vessels made in differing styles or techniques (or out of non-local raw materials), referred to as 'entangled vessels' (Stockhammer 2011; 2012).

- Strand 7: Recognition of different chemical raw material groups

In order to gain knowledge about the raw material used, the chemical composition of pottery will be measured in large quantities using p-XRF. Then, (multivariate) statistics will be used to recognize different raw material groups, as well as outliers.

With the 'objective knowledge' (Harrits 2011) gained in phase 2 of the project alone, we can not explain why certain practices in pottery making were reproduced or why they were transformed or changed in a certain period of time. Nor would this explain the entangled vessels and what role the mobility of people and the encounter of potters from different communities of practice might have played.

- **Phase 3: Approaching the making of single vessels ('habitus')**

To understand these dynamic phenomena, we need to move beyond the perspective of socially shared pottery practices to cases concerning the individual perspective of making a single pot (chaîne opératoire). The concept of habitus links thereby the social with the actor, the socially shared dispositions and strategies of making pots with available raw materials and individual abilities being the agency in a certain situation (see also Bourdieu 1977; Boivin 2008; Stockhammer 2011; 2012a; Müller-Scheeßel/Burmeister 2006; Schreg et al. 2013). For the following, single vessels from previously elaborated groups will be selected.

- Strand 8: Thin-section analysis of selected vessels

Thin-section analysis of selected pottery shards will be performed to determine their mineralogical and petrographic composition in order to pinpoint their geological origin. Secondly, information about taphonomy and technical details (preparation of clays and temper, shaping, firing etc.) can also be gained.

- Strand 9: Chemical composition analysis of selected vessels

To check the stability of the groups elaborated by p-XRF, more precise laboratory XRF-methods will be implemented. They will deliver a wider chemical spectrum, providing us with additional information on the clays that were used. Finally, reference groups for each settlement of the considered research area can be established.

- Strand 10: Approaching the making of (entangled) vessels

Bringing together the results of the preceding strands, the production of selected vessels will be reconstructed as far as possible (see Dobres/Robb 2000; Martineau et al. 2007; Knapp/van Dommelen 2008; Knappett 2011). The choices involved in making pots will reveal the individual agency and creativity of the actors within the framework of social practice. Thereby a special focus needs to be laid on the deviant 'entangled pots' that are made from non-local raw materials, decorated in a different style or shaped with different techniques. These deviations are linked with the mobility of people, materials, things and ideas. In some

cases they might give us a glimpse at moments of encounters with the 'new'/ 'other' – different habitus so to speak – and the triggered dynamic of such situations: appropriations, rejections, transformations and the creation of new things and practices.

5. Some words on applied methods

In the following, three methods and the way we strive to apply them will be described. Their combination is well established in some fields of research but is relatively new to the topic of this project.

Portable energy dispersive XRF (p-XRF) thin-section analysis (TS)

Raw material analysis of the archaeological finds are crucial to differentiate locally and non-locally produced artefacts and thus to identify mobility, social networks and entanglements of Neolithic societies. Traditional XRF-analysis (for example WD-XRF or XRD) has been used for many years in material analysis for the provenance determination and characterisation of raw materials. The results are of high quality, although the analyses are expensive because of the time consuming preparation of the samples. Thin-section analysis is often used to get additional information about raw materials (matrix and additional non-plastic parts /'temper') and aspects of the production (chaîne opératoire) of pottery (Fig. 8). The already-existing data of the project's research area are very promising (e.g. Freudinger-Bonzon 2005; Diethelm 1994; Diethelm-Loch 1983, Nungässer/ Maggetti/Stöckli 1985). However, until now only a small amount of pottery has been analysed with archeometrical methods (Maggetti 2009), even though raw material analyses play an important role in the study of prehistoric societies.

The portable XRF-analysis offers an additional way to analyse the elementary composition of large quantities of artefacts in a non-destructive and rapid manner (Litzris/ Zacharisas 2012; Helfert 2013; Helfert et al. 2011; Mecking et al. 2012; Shackley 2012a). The method is relatively new to our discipline and has never been applied to prehistoric pottery in Switzerland so far. In order to test the potential of p-XRF analysis for our research project we made two pre-tests with imported and local stone artefacts and selected pottery originating from different sites at Lake Bienne in October 2010 (Stapfer 2012) and March 2014. These pre-tests are promising: it is possible to discern imported black shale from local black stones as well as to differentiate clays/raw material sources of pottery originating from different sites.

The advantage of p-XRF lies in the larger amount of measurements that can be taken in a short time frame (testing up to 100 samples per day), providing a strong basis for statistical treatment of the data. Also, in practice, a portable analyser can be taken into museums and collections of heritage services. Thus, objects don't need to be taken out of their collection and transported to a laboratory but can be analysed in a non-destructive or minimally invasive manner in the institutions where they are stored (Fig. 9). Due to the lack of representative studies of Neolithic artefacts analysed by p-XRF in Switzerland, the analysing method has been developed by empirical tests (e.g. measuring time, measuring position, calibration of the analyzer see Helfert 2013) and the gathered p-XRF data has been cross-checked by traditional XRF analysis at the XRF Labo-

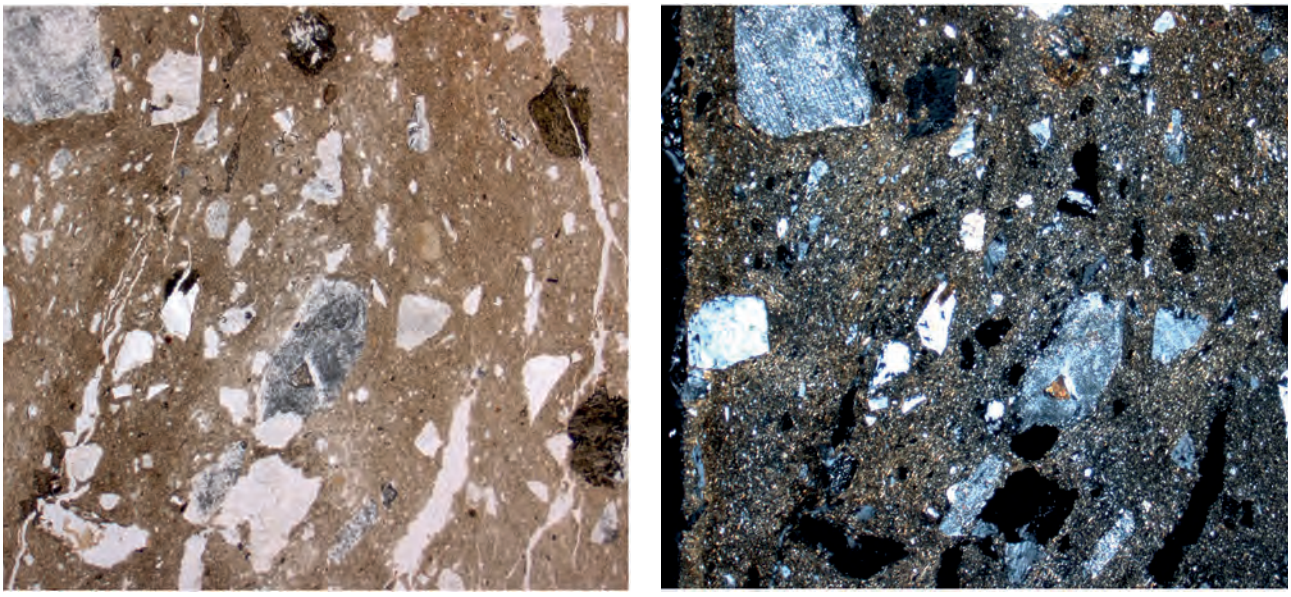


Fig. 8: Example of thin-sections representing a cut though a pottery shard in parallel and crossed polarized light (Ph. Rentzel).

Fig. 9: Example of p-XRF application (R. Stapfer).

ratory of the department of Geosciences of the University of Fribourg (head Prof. Dr. V. Serneels). The results of the traditional XRF analysis will further help to calibrate the p-XRF analyzer (see Shackley 2012b; Helfert 2013). Additional information about the production and chaîne opératoire of pottery will be obtained by thin-section analysis.

Multivariate analysis (MVA)

The classification of pottery on different analytical levels, like raw materials, modes of production and style calls for multivariate analysis of the variables. Explorative inductive statistical techniques, like e. g. cluster analysis, principal components analysis (PCA) or correspondence analysis (CA) will be evaluated and then implemented to explore structures of dependency (relations) and to explain the variance in our data (Bourdieu 1984; Bourdieu/Wacquant 1992; Bortz 1993; Baxter 1994; Shennan 1997; Zimmermann 1997). Thus, patterns of similarities can be revealed by a simultaneous observation of different variables. Such approaches have already been conducted in comparable projects (e. g. Höhn 2002; Hinz 2009; Furholt 2009, 2011; Doppler 2013, Jammer-Reynal 2006; Claßen 2008). Cluster analysis, PCA and discriminant analysis (DA) have been successfully implemented for the analysis of XRF data and the formation of chemical groups too (e. g. Freudiger-Bonzon 2005; Papachristodoulou et al. 2006; Helfert/Mecking/Lang et al. 2011). The recognized groups reflect social practices and shared knowledge in the manufacturing processes of material culture (see above). Therefore, multivariate statistics are a highly promising way to link approaches from social science with material culture studies.

6. Intended synthesis and anticipated impact of the project

In a first step, the findings from the two case studies will be connected within the project at local, regional and supra-regional scales in order to approach social practices and individual agency in pottery production and thereby entanglements resulting out of mobilities. The appropriation/rejection of the 'new/ 'different' and the possibly triggered transformations will be studied at decade level. Secondly, we aim to discuss these results in a broader perspective, comparing them with results from the raw material provenance of stone tools. Thereby, different scales, directions of and reasons for mobility can be approached. The ultimate aim is to propose models of mobility, entanglements and

transformations in Neolithic societies that lived between Lake Neuchâtel and Lake Constance in the 1st half of the 4th millennium BC.

We think that the MMR project as sketched out in this paper is significant for archaeology, archaeometry and other disciplines working on similar topics of material culture in past societies. It will bring new insights into the following research domains:

- **Ties between Neolithic societies in Middle Europe**

Over the last 20 years, wetland archaeology has concentrated on publishing single site monographs presenting huge amounts of archaeological material and data. Our project will reveal material culture entanglements and thereby social relationships by comparing the exceptionally well-preserved Neolithic UNESCO-Heritage wetland sites on the northern Alpine periphery (3900–3500 BC) with mineral soil sites in the French Jura Mountains, Burgundy, the Upper Rhine Valley regions and upper Swabia. Obviously, the cur- rent state of-the-art research shows many entanglements in the pottery and stone tools of these regions but profound studies to understand the phenomena have been missing.

- **Mobility in ancient societies**

In the 1950s and earlier, prehistoric migration was a topic of major concern but the various ranges of, and reasons for, mobility were neglected. New results coming from stable isotope analysis make mobilities of individuals more and more visible in ancient societies. Unfortunately, burials sites and human skeletal remains from Neolithic sites of the research area are too rare for stable isotope analysis. Since huge quantities of perfectly dated artefacts from wetland sites are available our project approaches mobility through material culture flows, where theories and methods still need to be improved. P-XRF and thin-section analysis combined with multivariate statistics will yield new insights into the frequent small-scale mobilities of individuals or into the migration processes of larger social groups. Our project promises to detect common local social practices of pottery production as well as the appropriation and use of locally available or imported stone implements.

- **Culture/cultures**

Questioning longstanding notions of archaeological 'cultures' in the chosen research areas will enable us to overcome problematic concepts that constrain our perceptions of, and the way in which we imagine, Neolithic societies. The project's theoretical output will be the appropriation of Pierre Broudieus's reflexive sociology and his praxeological approach to archaeology. Besides his habitus-concept, further concepts that also rest upon theories of human action will be brought together. These respect a more dynamic human-thing relationship than Bourdieu's approach and are therefore essential in order to understand agency/social practice in the light of mobilities, flows of things and ideas, leaving space for transformations. The latter will then challenge former notions of culture in their inability to describe such phenomena.

7. Scientific collaborations and education of young scholars

The project's research is organized in an interdisciplinary and international research network that brings together the knowledge of various disciplines (archaeology, archaeometry, geology, statistics), Universities (of Berne, Fribourg), Cultural Heritage Departments (Switzerland, France, Germany), as well as younger and experienced academics. The project's research group is in touch with experts of the project's scientific advisory board (P. Pétrequin, U. Seidel, and H. Schlichtherle) as well as researchers of current projects in the field. Research and education are linked by the two PhD programs, several master theses dealing with similar methodologies or topics from the same period and planned seminars/lectures given by project members for BA and MA students. In the context of the project a first international, interdisciplinary workshop has already been conducted on pottery and mobility from archaeological and anthropological perspectives where, next to experts, young scholars were also invited. (Fig. 10).

For further information on the project see also:
www.iaw.unibe.ch/forschung/abt_pa_ufg/mobilities_entanglements_and_transformations

MET

Mobilities, Entanglements & Transformations
in Neolithic societies on the Swiss Plateau

3 000

Neolithikum

4 000

Mobilities and Pottery Production
Archaeological and Anthropological Perspectives

Workshop: 5-6 June 2015
Institute of Archaeology (IAW), Prehistory, University of Bern

Top: Firing of pots in Ouangolodougou (Côte d'Ivoire, 2014) by Kathrin Heitz Tokpa. Bottom: Pots from the Neolithic settlement Thayngen in Museum Allerheiligen, Schaffhausen (Switzerland, 2013) by Caroline Heitz

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Fig. 10: Programm of the workshop 'Mobilities and Pottery Production: Archaeological and Anthropological Perspectives' held form 5 to 6 June at the University of Bern; pottery firing in northern Côte d'Ivoire in 2014 (K. Heitz-Tokpa) and pottery from the Neolithic bog settlement of Thayngen-Weier (C. Heitz).

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